CLAIMS

What is claimed is:

1	1.	A meth	hod for determining the positional BL factor of a transducer during sound
2	transduction comprising the steps of:		
3		(a)	changing the current to the transducer;
4		(b)	determining the current through the transducer;
5		(c)	measuring the back EMF of the transducer; and
6		(d)	calculating the positional BL factor from the change in EMF versus
7	change in curr	ent.	
1	2.	The m	ethod of claim 1, further comprising applying the drive signal to a switch
2	to drive the tra	ınsducer	to generate sound, wherein the drive signal is one of a digital and
3	analog.		
1	3.	A meth	nod for measuring the back EMF of a transducer comprising the steps of:
2		(a)	providing a digitally modulated signal; and
3		(b)	measuring the voltage across the transducer during the off time of the
4	digitally modu	ılated siş	gnal.
1	4.	The me	ethod of claim 3, further comprising applying the drive signal to a switch
2	to drive the tra	ınsducer	to generate sound, wherein the drive signal is digital or analog.

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A method for generating sound using a speaker having a transducer, comprising

CLAIMS

What is claimed is:

1	1.	A method for determining the positional BL factor of a transducer during sound	
2	transduction comprising the steps of:		
3		(a) changing the current to the transducer;	
4		(b) determining the current through the transducer;	
5		(c) measuring the back EMF of the transducer; and	
6		(d) calculating the positional BL factor from the change in EMF versus	
7	change in cur	rent.	
1	2.	The method of claim 1, further comprising applying the drive signal to a switch	
2	to drive the t	ansducer to generate sound, wherein the drive signal is one of a digital and	
3	analog.		
1	3.	A method for measuring the back EMF of a transducer comprising the steps of:	
2		(a) providing a digitally modulated signal; and	
3		(b) measuring the voltage across the transducer during the off time of the	
4	digitally mod	ulated signal.	
1	4.	The method of claim 3, further comprising applying the drive signal to a switch	
2	to drive the t	ransducer to generate sound, wherein the drive signal is digital or analog.	
1	5.	A method for generating sound using a speaker having a transducer, comprising	

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2	the steps of:		
3		(a)	determining the positional BL factor during sound transduction through
4	continual mea	asureme	ents; and
5		(b)	digitally modulating a drive signal based on a plurality of transducer
6	models and th	ne posit	ional BL factor during sound transduction of the transducer.
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2	6.	The n	nethod of claim 5, further comprising applying the drive signal to a switch
3	to drive the tr	ansduce	er to generate sound, wherein the drive signal is digital or analog.
1	7.	A me	thod for generating sound using a speaker having a transducer, comprising
2	the steps of:		
3		(a)	generating an electrophysical model of the transducer,
4		(b)	digitally modulating a drive signal based on the continually determined
5	position of the	e transd	lucer in the electrophysical model,
6		(c)	determining a positional BL factor during sound transduction through
7	continual mea	sureme	ents;
8		(d)	calculating the position of the transducer based upon the BL factor;
9		(e)	updating the position of the transducer in the electrophysical model; and
10		(f)	repeating steps b-e.
1	8.	The n	nethod of claim 7, wherein an electrophysical model of the transducer is

8. The method of claim 7, wherein an electrophysical model of the transducer is generated by driving the transducer with a known set of signals, determining the position of the transducer, and measuring one or more of: the back EMF, the power supply voltage, and the transducer current.

1	9.	The method of claim 7 further comprising applying the drive signal to a switch
2	to drive the tra	ansducer to generate sound, wherein the drive signal is digital or analog.
1	10.	A method for improving a sound generation device comprising the steps of:
2		(a) measuring a power supply voltage of the device; and
3		(b) adjusting a drive signal to the device to compensate for changes in the
4	power supply	voltage.
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1	11.	The method of claim 10 wherein the drive signal is adjusted by adjusting the
2	shape of the d	lrive signal.
1	12.	The method of claim 11 wherein the pulse shape is adjusted by adjusting the
2	amplitude and	d/or width of the pulse.
1	13.	The method of claim 10 wherein the drive signal is adjusted by adjusting the
2	amplitude of	the drive signal.
1	14.	The method of claim 10 which includes the step of generating a model of the
2	power supply	7.
1	15.	The method of claim 10 which includes the step of:
2		(e) modulating the output signal to minimize power supply induced distortion

3	(PSID), when	(PSID), wherein the output signal is provided to a switch to drive the transducer to generate		
4	sound, where	in the drive signal is digital or analog.		
1	16.	A method for protecting a speaker having a transducer comprising the steps of:		
2		(a) continually determining a drive power provided to the transducer and		
3		(b) adjusting the drive signal based upon a safe power model of the		
4		transducer and the drive power.		
1	17.	The method of claim 16 wherein the drive power is integrated over time.		
1	18.	The method of claim 16 which includes the step of measuring a power supply		
2	voltage to pro	ovide an output signal based upon the safe power model.		
1	19.	A system for determining the positional BL factor of a transducer during sound		
2	transduction	comprising:		
3		means for changing the current to the transducer;		
4		means fordetermining the current through the transducer;		
5		means for measuring the back EMF of the transducer; and		
6		means for calculating the positional BL factor from the change in EMF versus		
7	change in cur	rrent.		
1	20.	The system of claim 19, further comprising applying the drive signal to a switch		
2	to drive the tr	ransducer to generate sound, wherein the drive signal is one of a digital and		

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21.	A system for measuring the back EMF of a transducer comprising:
	means for providing a digitally modulated signal; and
	means for measuring the voltage across the transducer during the off time of the
digitally mod	ulated signal.

- 22. The system of claim 21, further comprising means for applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.
- 23. A system for generating sound using a speaker having a transducer, comprising: means for determining the positional BL factor during sound transduction through continual measurements; and

means for digitally modulating a drive signal based on a plurality of transducer models and the positional BL factor during sound transduction of the transducer.

- 24. The system of claim 23, further comprising means for applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.
 - 25. A system for generating sound using a speaker having a transducer, comprising: means for generating an electrophysical model of the transducer,

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3		means for digitally modulating a drive signal based on the continually
4	determined po	osition of the transducer in the electrophysical model,
5		means for determining a positional BL factor during sound transduction
6	through contin	nual measurements;
7		means for calculating the position of the transducer based upon the BL factor;
8	and	
9		means for updating the position of the transducer in the electrophysical model.
1	26.	The system of claim 25, wherein an electrophysical model of the transducer is
2	generated by	driving the transducer with a known set of signals, determining the position of the
3	transducer, an	nd measuring one or more of: the back EMF, the power supply voltage, and the
4	transducer cu	rrent.
1	27.	The system of claim 25 further comprising means for applying the drive signal
2	to a switch to	drive the transducer to generate sound, wherein the drive signal is digital or
3	analog.	
1	28.	A system for improving a sound generation device comprising the steps of:
2		means for measuring a power supply voltage of the device; and
3		means for adjusting a drive signal to the device to compensate for changes in

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the power supply voltage.

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29.	The system of claim 28 wherein the drive signal is adjusted by adjusting the
shape of the dr	ive signal.

- 30. The system of claim 29 wherein the pulse shape is adjusted by adjusting the amplitude and/or width of the pulse.
- 31. The system of claim 28 wherein the drive signal is adjusted by adjusting the amplitude of the drive signal.
- 32. The system of claim 28 which includes the means for generating a model of the power supply.
 - 33. The system of claim 28 which includes:

means for modulating the output signal to minimize power supply induced distortion (PSID), wherein the output signal is provided to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

- 34. A system for protecting a speaker having a transducer comprising:

 means for continually determining a drive power provided to the transducer and

 means for adjusting the drive signal based upon a safe power model of the

 transducer and the drive power.
- 35. The system of claim 34 wherein the drive power is integrated over time.
- The system of claim 34 which includes the step of measuring a power supply

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voltage to provide an output signa	l based upor	n the safe powe	r model.
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1	37.	A con	nputer readable medium containing program instructions for determining
2	the positional	BL fact	tor of a transducer during sound transduction comprising the steps of:
3		(a)	changing the current to the transducer;
4	•	(b)	determining the current through the transducer;
5		(c)	measuring the back EMF of the transducer; and
6		(d)	calculating the positional BL factor from the change in EMF versus
7	change in cur	rent.	
1	38.	The c	omputer readable medium of claim 37, further comprising applying the
2	drive signal to	o a swit	ch to drive the transducer to generate sound, wherein the drive signal is

- 39. A computer readable medium containing program instructions for measuring the back EMF of a transducer comprising the steps of:
 - (a) providing a digitally modulated signal; and
- (b) measuring the voltage across the transducer during the off time of the digitally modulated signal.
- 40. The computer readable medium of claim 39, further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

one of a digital and analog.

sound using a speaker having a transducer, comprising the steps of:

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A computer readable medium containing program instructions for generating

repeating steps b-e.

The computer readable medium of claim 43, wherein an electrophysical model

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of the transducer is generated by driving the transducer with a known set of signals,					
determining the position of the transducer, and measuring one or more of: the back EMF, the					
power supply voltage, and the transducer current.					

- 45. The computer readable medium of claim 43 further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.
- 46. A computer readable medium containing program instructions for improving a sound generation device comprising the steps of:
 - (a) measuring a power supply voltage of the device; and
- (b) adjusting a drive signal to the device to compensate for changes in the power supply voltage.
- 47. The computer readable medium of claim 46 wherein the drive signal is adjusted by adjusting the shape of the drive signal.
- 48. The computer readable medium of claim 47 wherein the pulse shape is adjusted by adjusting the amplitude and/or width of the pulse.
- 49. The computer readable medium of claim 46 wherein the drive signal is adjusted by adjusting the amplitude of the drive signal.
 - 50. The computer readable medium of claim 46 which includes the step of

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generating a	model	or the	power	suppiy.

- 51. The computer readable medium of claim 46 which includes the step of:

 (e) modulating the output signal to minimize power supply induced distortion

 (PSID), wherein the output signal is provided to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.
 - 52. A computer readable medium containing program instructions for protecting a speaker having a transducer comprising the steps of:
 - (a) continually determining a drive power provided to the transducer and
 - (b) adjusting the drive signal based upon a safe power model of the transducer and the drive power.
- 53. The computer readable medium of claim 52 wherein the drive power is integrated over time.
- 54. The computer readable medium of claim 52 which includes the step of measuring a power supply voltage to provide an output signal based upon the safe power model.